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Publications of the Exobiology Program for 1989

A Special Bibliography

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INTRODUCTION

The Exobiology Program, within the Office of Space Science and Applications of the National Aeronautics and Space Administration, is an integrated program designed to investigate those processes that may have been responsible for or related to the origin, evolution, and distribution of life in the universe.

This report contains a listing of 1989 publications resulting from research supported by the Exobiology Program. Our intent in compiling this report is twofold: We want to provide the scientific community with an annual publication listing (as we have done since 1975) of current NASA-supported research in this field, and we hope to stimulate the exchange of information and ideas among scientists working in the different areas of the program.

Research supported by the Exobiology Program is explored in the areas of Cosmic Evolution of Biogenic Compounds, Prebiotic Evolution, Early Evolution of Life, and Evolution of Advanced Life. Pre-mission and pre-project activities supporting these areas are supported in the areas of Solar System Exploration and Search for Extraterrestrial Intelligence. The Planetary Protection subject area is included here because of its direct relevance to the Exobiology Program.

EACH AREA IS DEFINED AS FOLLOWS:

COSMIC EVOLUTION OF BIOGENIC COMPOUNDS focuses on the history of the biogenic elements (C,H,N,O,P,S) and their compounds in the galaxy and the early solar system. This includes: (1) tracing the physical and chemical pathways taken by the biogenic elements and their compounds from their origins in stars to their incorporation in the pre-planetary bodies; (2) determining the kinds of measurements that can be made on the biogenic elements and compounds in the galaxy and solar system and prebiotic evolution and origin of life; and (3) determining the ways in which the physical and chemical properties of the biogenic elements and compounds may have influenced the course of events during the formation of the solar system and the component bodies.

PREBIOTIC EVOLUTION involves research and analysis in two major areas: (1) the consequences of planetary evolution on the physical environment of the Earth and planets, and (2) the evolution of molecules and molecular systems under the constraints imposed by the physical environment and the appearance, a posteriori, of living systems on Earth. It also assesses the importance of the physical-chemical processes associated with the dynamic development of planetary surfaces.

EARLY EVOLUTION OF LIFE focuses on the nature of the most primitive organisms, determining the environment in which they evolved, and the way in which they influenced that environment. Investigations are executed through the use of the molecular record in living organisms and the geological record in rocks. These records are used to determine when and in what setting life first appeared; to determine the characteristics of the first successful living organisms; to understand the phylogeny and physiology of microorganisms that inhabit hydrothermal areas now thought to be analogs of primitive environments; to determine the original nature of biotic energy transduction, membrane function, and information processing through study of extant microbes; and to elucidate the physical, chemical, and biotic forces operating on microbial evolution.

EVOLUTION OF ADVANCED LIFE examines the influence of astrophysical, stellar and solar system events on the evolution of advanced life on Earth. Research in this area attempts to understand possible evolutionary pathways for advanced life and to develop a program plan for a paleontological data base.

SOLAR SYSTEM EXPLORATION focuses on providing specific information on the elemental and chemical composition, mainly with respect to gases and volatiles, of the atmospheres and surfaces of solar system bodies, including planets and their satellites, comets, asteroids, meteorites, and dust in space. Improved methods, instrumentation, and experiments will be developed for in situ chemical analyses of the volatile species associated with the bodies to be investigated.

SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) involves the search for extraterrestrial intelligent life by detecting signals in the electromagnetic spectrum. Principal emphasis has been on technology development for the microwave observing project.

PLANETARY PROTECTION focuses on environmental protection of planets of biological interest from potentially harmful contamination from terrestrial sources during future exploration, based on explicit guidelines established for each planet and for each type of mission. It also focuses on protection of the Earth from potential hazards posed by returned sample missions.

This bibliography is divided into the areas noted above. Within each research area, references are listed alphabetically by author. Authors who are Principal Investigators are identified by an asterisk. In addition, current addresses for all Principal Investigators are given in the Appendix.

We wish to thank all the participants in the Exobiology Program for their cooperation in responding to our request for a listing of their 1989 publications. We also wish to thank Janice Wallace-Robinson and F. Ronald Dutcher for their editorial and technical assistance and Audrey Brown and Stephen Szibler for their technical assistance.

John D. Rummel
Exobiology Program Manager
March, 1991

COSMIC EVOLUTION OF BIOGENIC COMPOUNDS

Allamandola*, L.; Bar-Nun, A.; Brock, T.; Chang*, S.; Davies, R.E.; Greenberg, J.M.; Hochstein*, L.; Horneck, G.; Huntress, W.; Miller*, S.; Nealson, K.; Usher*, D.
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Lunar and Planetary Science Conference XX: 84-85, 1989. (GWU 11396)

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PREBIOTIC EVOLUTION

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16. Abstract

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